REMARKS

In sections 4 and 5 of the Office Action, the Examiner rejected claims 60-72 79-84 under 35 U.S.C. §112, first paragraph, as failing to comply with the written description requirement. Specifically, the Examiner asserts that the written description of the application does not describe deriving a constellation of signal values.

Accordingly, claim 60 has been amended to change the word "constellation" to the word "set." This amended represents no change in scope since constellation means set. Therefore, since the written description of the application describes deriving a set of signal values (see the brief description of Figure 5 for example), the written description of the application necessarily describes deriving a constellation of signal values.

Claim 79 has been amended to simply eliminate the word "constellation."

In section 7 of the Office Action, the Examiner rejected claims 60-66, 68, and 79-83 under 35 U.S.C. §103(a) as being unpatentable over Calderbank in view of Molnar.

Calderbank describes first and second transmitters 10 and 30 that employ space-time block

coding units 13 and 33 followed by constellation mapper and pulse shaping circuits 16 and 36. The bits to the space-time block encoders are divided into groups of two bits each, and the two bits in each group $\{c_1, c_2\}$ are transmitted simultaneously, with c_1 being transmitted from antennas 11 and 31 and c_2 being transmitted from antennas 12 and 32. In the next bit period, $-c_2^*$ is transmitted from the antennas 11 and 31, and c_1^* is transmitted from the antennas 12 and 32.

In a receiver 20, the received signal from antennas 21 and 22 is applied to a detector 25. A channel estimator 23 estimates the channel associated with the antenna 21, and a channel estimator 24 estimates the channel associated with the antenna 22. These channel estimates are applied to the detector 25.

The detector 25 of the receiver 20 includes a maximum likelihood decoder 26, a soft decision generator 27, and a channel decoder 28. The maximum likelihood decoder 26 decodes the received signal to produce a decoded bit pair $\hat{c}$ by minimizing $\|r - H\hat{c}\|^2$, where r represents the received signal and H represents the channel estimate. An uncertainty factor Δ_c that the bit pair $\hat{c}$ has been determined correctly is given by $\Delta_c = \|r - H\hat{c}\|^2$.

The soft decision generator 27 forms soft decisions of the transmitted bits, and these soft decisions are fed to the channel decoder 28. The channel decoder 28 reverses the coding implemented by the channel encoders 14 and 34.

Independent claim 60 - In rejecting independent claim 60, the Examiner points to paragraphs 0018 and 0020 of Calderbank for the receiving limitation. Thus, the Examiner is apparently asserting that the received signal is designated r and that it contains a code vector in the form of (c_1, c_2, c^*_1, c^*_2).

Then, the Examiner points to paragraphs 0010 and 0020 of Calderbank for the decoding limitation. Thus, the Examiner is apparently asserting that the code vector (c_1, c_2, c^*_1, c^*_2) is decoded, as shown in equation (6) by (i) multiplying the channel estimate by each of the possible pairs of bits that could have been transmitted as c_1 and c_2, (ii) forming a difference between the received signal r and each multiplication result, and (iii) selecting the possible bit pair that produces the smallest difference as c_1 and c_2. Further, it appears that the Examiner is asserting that this decoding derives a set of received signal values (c_1 and c_2) that correspond to the code vector (c_1, c_2, c^*_1, c^*_2).

Finally, the Examiner points to paragraph 0032 of Calderbank for the reliability generating limitation. The Examiner recognizes that paragraph 0032 only vaguely mentions soft decisions and does not suggest either that soft decisions include a confidence value or how the confidence values are formed.

However, the Examiner could have pointed to the uncertainty factor Δ_c described in paragraph 0019. The uncertainty factor Δ_c is the smallest difference that is produced during the maximum likelihood decoding process. Thus, the Examiner could have argued that the uncertainty factor Δ_c is a reliability factor, that the uncertainty factor Δ_c is based upon at least one of the received signal values c_1 and c_2, and that the uncertainty factor Δ_c is a measure of reliability of the decoding.

However true any of these assertions might be, it is clear that Calderbank does not generate a reliability factor based upon a difference between at least two of the received signal values.

<u>Molnar</u> - The Examiner also relied upon Molnar in the rejection of claim 60, pointing specifically to column 4, lines 35-42 and column 9, lines 48-67.

Molnar according to column 4, lines 35-42 is directed to an improved method for equalization and

detection of maximum a-posteriori (MAP) probabilities of differential bits associated with differential-QPSK (D-QPSK) modulation and that an iterative approach is used for computing bit probabilities from soft-detected symbol values which are used for bit detection. Alternately, the bit probabilities can be computed using a post-processing step from a previous equalization process.

Molnar in column 9, lines 48-67 states that $\hat{r}_n$ values are passed to the bit probability detector 91 to detect soft bits $d^{(p-1)}$ such that each soft bit d includes a probability associated with each of the possible values the bit can have. Vector $\hat{r}_n$ is derived from the expected value of $r_n|y$ and has its t^{th} value equal to $p(r_n = e_n|y)$ where e_n is a unit vector with a one at its t^{th} position and zeros elsewhere. The soft bits are stored in the buffer 73 and decoded using the decoder 75. The decoder 75 performs a decoding validity check using a CRC check or other error detection and/or correction techniques. The decoder 75 passed the bits on for further processing only if the decoding is valid.

Thus, Molnar, like Calderbank, does not disclose generating a reliability factor based upon a difference between at least two of the received signal

values. Indeed, Molnar does not disclose how the bit probability detector 91 calculates bit probabilities.

Accordingly, because Calderbank and Molnar do not disclose generating a reliability factor based upon a difference between at least two of the received signal values, one of ordinary skill in the art would not have been led by Calderbank and Molnar to produce the invention of independent claim 60.

Therefore, independent claim 60 is not unpatentable over Calderbank in view of Molnar.

Independent claim 79 - The Examiner does not address independent claim 79 separately from independent claim 60 even though these two independent claims are very different.

Specifically, the Examiner does not point to any portion of either Calderbank or Molnar that discloses deriving a plurality of sets of values corresponding to the received code vector, wherein one of the sets contains a value that is largest, and decoding the received code vector according to the set of values containing the largest value.

Calderbank describes decoding the received signal by determining which pair of possible symbol pairs, when multiplied by the channel estimate, produces

the smallest magnitude difference when subtracted from the received signal. There is no disclosure in Calderbank that the pair of possible symbols producing this smallest magnitude difference contains the largest value.

Further, while the Examiner seems to assert that the received signal r contains a code vector (c_1, c_2, c^*_1, c^*_2) pointing to equations (2) and (3), the Examiner has failed to point out in Calderbank what sets of values are derived from (c_1, c_2, c^*_1, c^*_2) and which set has the largest value and is used to decode the code vector (c_1, c_2, c^*_1, c^*_2) according to the set of values containing the largest value.

Molnar similarly does not disclose deriving a plurality of sets of values corresponding to the received code vector, wherein one of the sets contains a value that is largest, and decoding the received code vector according to the set of values containing the largest value.

Because neither Calderbank nor Molnar discloses deriving a plurality of sets of values corresponding to the received code vector, wherein one of the sets contains a value that is largest, and decoding the received code vector according to the set of values

containing the largest value, one of ordinary skill in the art would not have been led by Calderbank and Molnar to produce the invention of independent claim 79.

Therefore, independent claim 79 is not unpatentable over Calderbank in view of Molnar.

Because independent claims 60 and 79 are not unpatentable over Calderbank in view of Molnar, dependent claims 61-66, 68, and 80-83 likewise are not unpatentable over Calderbank in view of Molnar.

In section 8 of the Office Action, the Examiner rejected claims 67, 69-72, and 84 under 35 U.S.C. §103(a) as being unpatentable over Calderbank in view of Molnar and further in view of Khayrallah.

Khayrallah does not suggest generating a reliability factor based upon a difference between at least two received signal values that are derived by decoding a received vector.

Because Calderbank and Molnar likewise do not suggest generating a reliability factor based upon a difference between at least two of the received signal values, one of ordinary skill in the art would not have been led by Calderbank, Molnar, and Khayrallah to produce the invention of independent claim 60.

Therefore, independent claim 60 is not unpatentable over Calderbank in view of Molnar and further in view of Khayrallah. Because independent claim 60 is not unpatentable over Calderbank in view of Molnar and further in view of Khayrallah, dependent claims 67 and 69-72 are likewise not unpatentable over Calderbank in view of Molnar and further in view of Khayrallah.

Moreover, the Examiner points to C_{max} of Khayrallah as the largest one of the received signal values derive from decoding a received code vector and that C_{max} is use to generate a reliability factor.

However, with regard to C_{max}, Khayrallah states that, after synchronization, $C(\tau)$ are quantities related to the magnitude squared of the sync correlation values corresponding to channel tap delays τ, and C_{max} is the largest of these values corresponding the strongest signal ray. According to Khayrallah, $\gamma(\tau)$ values are determined from C_{max} and are used to determine step sizes μ_0 and μ_1. These step sizes μ_0 and μ_1 are step sizes of a matrix M, the matrix M is used to determine a state vector x, and the state vector x corresponds to the states of the channel coefficients.

As can be seen, C_{max} is not used to decode a code vector. Therefore, Khayrallah does not suggest

deriving a plurality of sets of values corresponding to a received code vector, wherein one of the sets contains a value that is largest, and decoding the received code vector according to the set of values containing the largest value.

Similarly, neither Calderbank nor Molnar suggests deriving a plurality of sets of values corresponding to the received code vector, wherein one of the sets contains a value that is largest, and decoding the received code vector according to the set of values containing the largest value. Accordingly, one of ordinary skill in the art would not have been led by Calderbank, Molnar, and Khayrallah to produce the invention of independent claim 79.

Therefore, independent claim 79 is not unpatentable over Calderbank in view of Molnar and further in view of Khayrallah. Because independent claim 79 is not unpatentable over Calderbank in view of Molnar and further in view of Khayrallah, dependent claim 84 is likewise not unpatentable over Calderbank in view of Molnar and further in view of Khayrallah.

In section 9 of the Office Action, the Examiner rejected claims 73-77 under 35 U.S.C. §103(a) as being

unpatentable over Calderbank in view of Molnar and further in view of Popovic.

As the Examiner has recognized, neither Calderbank nor Molnar discloses decoding a received code vector by correlating the received code vector with a plurality of reference code vectors so as to produce a plurality of values corresponding to each of the reference code vectors, and generating a decoding reliability factor based upon at least one of the values.

Popovic shows a cyclic correlator 100 in Figure 1 in which a reference code word is cyclically shifted through a shift register 120 n-1 times, where n is a number of code words into which m bits are coded. For purposes of the drawings in Popovic, n = 4 (there are four code words) and m = 2 (there are two bits formed into the four code words).

Popovic shows a transmitter in Figure 2 that includes a cyclic space-time coder 200 for generating the four code words from each pair of bits x_1 and x_2. These four code words are (i) x_1, x_2, $-x_1$, x_2 transmitted by an antenna 205, (ii) x_2, $-x_1$, x_2, x_1 transmitted by an antenna 204, (iii) $-x_1$, x_2, x_1, x_2 transmitted by an antenna 203, and (iv) x_2, x_1, x_2, $-x_1$ transmitted by an antenna 202.

These four transmitted code words are received by the receiver of Figure 1.

The cyclic correlator 100 performs a circular correlation between the received code word and, in turn, each of the four reference code words that are possible combinations of the two information bits. A first of the four reference code words is shifted through a register 120 and, at each shift, the values in the register 120 are multiplied by corresponding values of the received samples, the four multiplication results are summed to produce c_k, and c_k is multiplied by a channel estimate α_k to produce a value $(c_k)(\alpha_k)$. This process is repeated three more times as three shifts of the current reference code word are performed to produce three values $(c_k)(\alpha_k)$. The four values $(c_k)(\alpha_k)$ are summed to produce a first decision metric Z_1.

The entire process is then repeated three more times for each of the three remaining reference code words to produce three more decision metrics Z_1. The reference code word corresponding to the largest of the four metrics is used to decode the received signal to recover the bits x_1 and x_2.

As can be seen, Popovic does not suggest using the decision metrics Z_1 to produce a reliability factor.

Moreover, while both Calderbank and Popovic describe space-time coding for the transmission of data, they use different decoding techniques, and while Calderbank describes a manner of determining an uncertainty factor related to the decoded information, this manner of determining an uncertainty factor is not applicable to Popovic.

The present application might suggest using the difference between the largest and next largest metric Z_1 to form a reliability or uncertainty factor. However, Calderbank suggests no such thing since Calderbank decodes by implementing maximum likelihood decoding to find the minimum difference between the received signal and each possible combination of bit values multiplied by the channel estimate and using this minimum difference as the uncertainty factor.

Calderbank also mentions soft decisions but does not suggest that soft decisions include a confidence value or that confidence values can be formed from correlation values.

Molnar, like Calderbank, does not disclose or suggest generating a reliability factor from correlation values. Indeed, Molnar does not disclose correlation or

the manner in which the bit probability detector 91 calculates bit probabilities.

Accordingly, since Calderbank, Molnar, and Popovic do not disclose or suggest generating a reliability factor from correlation values, one of ordinary skill in the art would not have been led by Calderbank, Molnar, and Popovic to produce the invention of independent claim 73.

Therefore, independent claim 73 is not unpatentable over Calderbank in view of Molnar and further in view of Popovic.

Because independent claim 73 is not unpatentable over Calderbank in view of Molnar and further in view of Popovic, dependent claims 74-77 are likewise not unpatentable over Calderbank in view of Molnar and further in view of Popovic.

<u>In section 10 of the Office Action</u>, the Examiner rejected claim 78 under 35 U.S.C. §103(a) as being unpatentable over Calderbank in view of Molnar and further in view of Popovic and still further in view of Khayrallah.

Khayrallah likewise does not disclose or suggest generating a reliability factor from correlation values. Accordingly, since Calderbank, Molnar, Popovic,

and Khayrallah do not disclose or suggest generating a reliability factor from correlation values, one of ordinary skill in the art would not have been led by Calderbank, Molnar, Popovic, and Khayrallah to produce the invention of independent claim 73.

Therefore, independent claim 73 is not unpatentable over Calderbank in view of Molnar and further in view of Popovic and still further in view of Khayrallah.

Because independent claim 73 is not unpatentable over Calderbank in view of Molnar and further in view of Popovic and still further in view of Khayrallah, dependent claim 78 likewise is not unpatentable over Calderbank in view of Molnar and further in view of Popovic and still further in view of Khayrallah.

<u>Independent claim 66</u> is directed to generating a reliability factor based upon a comparison of a received signal value, which is derived from decoding of a received signal, to a threshold.

Calderbank, Molnar, Popovic, and Khayrallah do not disclose or suggest generating a reliability factor in this manner.

Therefore, independent claim 66 is not unpatentable over Calderbank, Molnar, Popovic, and/or Khayrallah.

CONCLUSION

In view of the above, allowance of these claims and issuance of the above captioned patent application are respectfully requested.

The Commissioner is hereby authorized to charge $210 the fee for an additional independent claim and any additional fees which may be required, or to credit any overpayment to Account No. 26 0175.

Respectfully submitted,
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